



A.D. 1859, 13<sup>th</sup> JULY. N<sup>o</sup> 1657.

S P E C I F I C A T I O N

OF

CHARLES SAMUEL WALKER  
AND  
ROBERT HOYLE.

APPARATUS FOR CONSUMING SMOKE, AND  
PREVENTING THE EXPLOSION OF  
STEAM BOILERS.

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A.D. 1859, 13th JULY. N<sup>o</sup> 1657.

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**Apparatus for Consuming Smoke, and Preventing the  
Explosion of Steam Boilers.**

**LETTERS PATENT** to Charles Samuel Walker and Robert Hoyle, both of Bury, in the County of Lancaster, Engineers, for the Invention of “**IMPROVEMENTS IN MACHINERY OR APPARATUS FOR PROMOTING THE CONSUMPTION OF SMOKE IN STEAM BOILER AND OTHER FURNACES, AND FOR PREVENTING THE EXPLOSION OF STEAM BOILERS.**”

Sealed the 11th January 1860, and dated the 13th July 1859.

**PROVISIONAL SPECIFICATION** left by the said Charles Samuel Walker and Robert Hoyle at the Office of the Commissioners of Patents, with their Petition, on the 13th July 1859.

We, CHARLES SAMUEL WALKER and ROBERT HOYLE, both of Bury, in  
5 the County of Lancaster, Engineers, do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN MACHINERY OR APPARATUS FOR PROMOTING THE CONSUMPTION OF SMOKE IN STEAM BOILER AND OTHER FURNACES, AND FOR PREVENTING THE EXPLOSION OF STEAM BOILERS,**” to be as follows :—

The first part of our Invention consists in applying air between two or  
10 more bridges, and in the machinery for regulating the time during which the air is admitted. This machinery consists of a cylinder furnished with a piston connected to the door of the furnace, and to the door, damper, or valve through which air enters between the bridges. When the furnace door is opened to feed the fire with fresh coal the piston is raised, thereby filling the cylinder  
15 with air or other fluid, and the door, damper, or valve is opened, and the descent of the piston depends on the orifice through which the air or other fluid is allowed to escape from the cylinder. This orifice can be increased or diminished in any convenient manner when more than two bridges are



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*Walker & Hoyle's Impts. in Machinery for the Consumption of Smoke, &c.*

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employed. The air can be heated before it is admitted into the flue; in locomotive steam engines the air is admitted in the smoke box.

Our improvements in machinery for preventing the explosion of steam boilers, consists of an improved combination of parts to indicate the level of the water, and to open the safety or other valves. In performing our Invention, 5 we employ a dial and an index, to the spindle of which is fixed a cam and a pinion; this pinion gears in a segment connected to a float lever. When the water is either too high or too low the cam raises a valve, and admits steam to a whistle or other alarum, and opens the safety valve or valves by means of a connecting rod and lever. The valve of the steam whistle is weighted, and 10 is made so that the steam can raise it when it has attained a given pressure.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Charles Samuel Walker and Robert Hoyle in the Great Seal Patent Office on the 13th January 1860.

**TO ALL TO WHOM THESE PRESENTS SHALL COME**, we, CHARLES 15 SAMUEL WALKER and ROBERT HOYLE, both of Bury, in the County of Lancaster, Engineers, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Thirteenth day of July, in the year of our Lord One thousand eight hundred and fifty-nine, in the twenty-third year of Her reign, did, 20 for Herself, Her heirs and successors, give and grant unto us, the said Charles Samuel Walker and Robert Hoyle, Her special licence that we, the said Charles Samuel Walker and Robert Hoyle, our executors, administrators, and assigns, or such others as we, the said Charles Samuel Walker and Robert Hoyle, our executors, administrators, and assigns, should at any time agree with, 25 and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "**IMPROVEMENTS IN MACHINERY OR APPARATUS FOR PROMOTING THE CONSUMPTION OF SMOKE IN STEAM BOILER 30 AND OTHER FURNACES, AND FOR PREVENTING THE EXPLOSION OF STEAM BOILERS,**" upon the condition (amongst others) that we, the said Charles Samuel Walker and Robert Hoyle, our executors or administrators, by an instrument in writing under our or their, or one of our or their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in 35 what manner the same was to be performed, and cause the same to be filed



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in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

**NOW KNOW YE**, that we, the said Charles Samuel Walker and Robert Hoyle, do hereby declare the nature of our said Invention, and in what  
5 manner the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say):—

The first part of our Invention consists in an improved mode of applying air between two or more bridges, and in the machinery for regulating the time during which the air is admitted. This machinery consists of a cylinder  
10 furnished with a piston connected to the door of the furnace and to the door, damper, or valve, through which air enters between the bridges. When the furnace door is opened to feed the fire with fresh coals, the piston is raised, thereby filling the cylinder with air or other fluid, and the door, damper, or valve is opened, and the descent of the piston depends on the orifice through  
15 which the air or other fluid is allowed to escape from the cylinder; this orifice can be increased or diminished in any convenient manner. When more than two bridges are employed, the air can be heated before it is admitted into the flue. In locomotive steam engines the air is admitted in the smoke box.

Our improvements in machinery for preventing the explosion of steam  
20 boilers consists of an improved combination of parts to indicate the level of the water, and to open the safety or other valve. In performing our Invention, we employ a dial and an index, to the spindle of which is fixed a cam and a pinion; this pinion gears in a segment connected to a float lever. When the water is either too high or too low, the cam raises a valve and admits steam  
25 to a whistle or other alarum, and opens the safety valve or valves by means of a connecting rod and lever. The valve of the steam whistle is weighted, and is made so that the steam can raise it when it has attained a given pressure.

And in order that our Invention may be fully understood and readily  
30 carried into effect, we will proceed to describe the accompanying Sheet of Drawings, reference being had to the figures and letters marked thereon.

Figure 1 is an elevation, and Figure 2 a longitudinal section of the end of a steam boiler, to which our improvements are applied; Figure 3 is a detached view of part of our improvements. *a* is the outer casing or shell of the  
35 boiler; *b, b*, the flues; *c, c*, the doors of the furnace or fire-grates *d*; *e* is a box attached to the end of the boiler, containing the cylinders *f, f*, each of which is furnished with a piston *g*, valve *g*<sup>1</sup>, and screw tap *g*<sup>2</sup>, seen in Figure 2. The piston rods are jointed to the levers *h*, fixed to the shaft *i*, to which are also fixed the levers *j*, which are acted upon by the horizontal levers *k* and the



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excentrics  $l$ , the hinge pin of each fire door  $c$  being provided with one excentric; to the shaft  $i$ , are also fixed the levers  $m$ , to which one end of the link  $n$  is jointed, the other end being connected to the swivel door, damper, or valve  $o$ , which is hinged in an opening provided for it in the front part  $b^1$  of the bridge. The door  $o^1$  is also hinged in the same opening as the damper  $o$ ; 5 this door  $o^1$  is made of wirework, or otherwise perforated for the purpose of dividing the air entering between the front part  $b^1$  and back part  $b^2$  of the bridge. The mode of operation is as follows:—When the furnace door  $c$  is opened to feed the fire with fresh fuel, the excentric  $l$ , acting on the horizontal lever  $k$  and vertical lever  $j$ , causes the shaft  $i$  to swivel partly round, and in 10 so doing the damper  $o$  is opened by the lever  $m$  and link  $n$ ; the piston  $g$  is at the same time raised from the lower to the upper end of the cylinder  $f$ , and while the piston  $g$  is rising, the valve  $g^1$  admits air or other fluid into the cylinder. As soon as the door  $c$  is closed the excentric  $l$  ceases to act on the lever  $k$ , and the piston  $g$  is at liberty to descend in the cylinder  $f$  at a speed 15 varying according to the size of the orifice in the screw tap  $g^2$ , through which the air or other fluid escapes from the cylinder; and as the damper  $o$  is connected to the piston  $g$  by the levers and other parts above enumerated, it is evident that the damper  $o$  will be closed more or less rapidly according to the size of the orifice in the tap  $g^2$ ; or the damper  $o$  may be kept closed until 20 the fuel has been put on the fire and opened by the closing of the furnace door  $c$ .

By means of these improvements in machinery or apparatus for promoting the consumption of smoke in steam boiler or other furnaces, a fresh supply of air is admitted between the bridges  $b^1$  and  $b^2$  every time the furnace door is 25 opened or closed, and this supply is gradually cut off by the descent of the piston  $g$  in proportion to the reduced quantity of smoke evolved by the coal. The fresh air, after passing the damper  $o$ , is divided into small streams by the perforated door  $o^1$ , which is hinged at  $o^2$  for the purpose of being able to clean out the space between the bridges. When more than two bridges are 30 employed, the air can be heated before is admitted into the flue. In locomotive steam engines the air is admitted into the smoke box by a similar arrangement of machinery.

Our improvements in machinery for preventing the explosion of steam boilers consist in the following parts:— $p$  is a dial attached to the front of the 35 boiler, and  $q$  is an index fixed to the spindle or shaft  $r$ , to which is fixed the cam  $r^1$  and pinion  $r^2$ ; this pinion gears in the segment  $s$ , forming part of the float lever  $s^1$ ; the fulcrum stud of this lever and the end of the shaft  $r$  are supported in a cross stay or other convenient fixture attached inside the boiler.



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To one end of the lever  $s^1$  is suspended the float  $s^2$ , and to the other end is connected the counterweight  $s^3$ . The extremity of the shaft  $r$  is provided with a crank pin  $r^3$ , taking into an open slot in the spindle  $t$  of the safety valve  $t^1$ . Above the dial  $p$  is the whistle  $p^1$ ; the steam for sounding this  
 5 whistle is admitted through the valve  $p^2$ , which is furnished with a weight  $p^3$ . The mode of operation is as follows:—When the water in the boiler is at its proper level, the lever  $s^1$  retains its horizontal position, as shewn in Figure 1; but as soon as the level becomes either too high or too low, the float lever  $s^1$  assumes a diagonal position, and the segment  $s$  causes the pinion  $r^2$  to rotate,  
 10 thereby bringing the cam  $r^1$  in contact with the bottom of the weight  $p^3$ , and admitting steam to the whistle  $p^1$  to give notice to the attendant; at the same time the crank pin  $r^3$ , acting on the spindle  $t$ , lifts the safety valve  $t^1$ , and allows the steam to blow off, and the index  $q$  points to the graduations on the dial  $p$  to indicate the level of the water in the boiler. If the water remains  
 15 at its proper level while the steam attains a greater pressure than that to which the valves  $p^2$  and  $t^1$  are weighted, the steam acting on the said valves raises them off their seatings in the usual manner, the slot in the spindle  $t$  being open, as shewn in Figure 3, to allow the valve  $t^1$  to rise without bringing the spindle against the crank pin  $r^3$ .

20 Having thus stated the nature of our Invention, and described the manner of performing the same, we declare that we claim,—

First, the improved combination of machinery or apparatus, shewn and described, for promoting the consumption of smoke in steam boiler and other furnaces.

25 Secondly, the application of a perforated door placed in the bridge to admit air to the flue, as described.

And, thirdly, the improved combination of machinery to indicate the level of the water in the boiler, and to open the safety or other valves, as shewn and described.

30 In witness whereof, we, the said Charles Samuel Walker and Robert Hoyle, have hereunto set our hands and seals, the Eleventh day of January, in the year of our Lord One thousand eight hundred and sixty.

CHARLES SAMUEL WALKER. (L.S.)

35 ROBERT HOYLE. (L.S.)

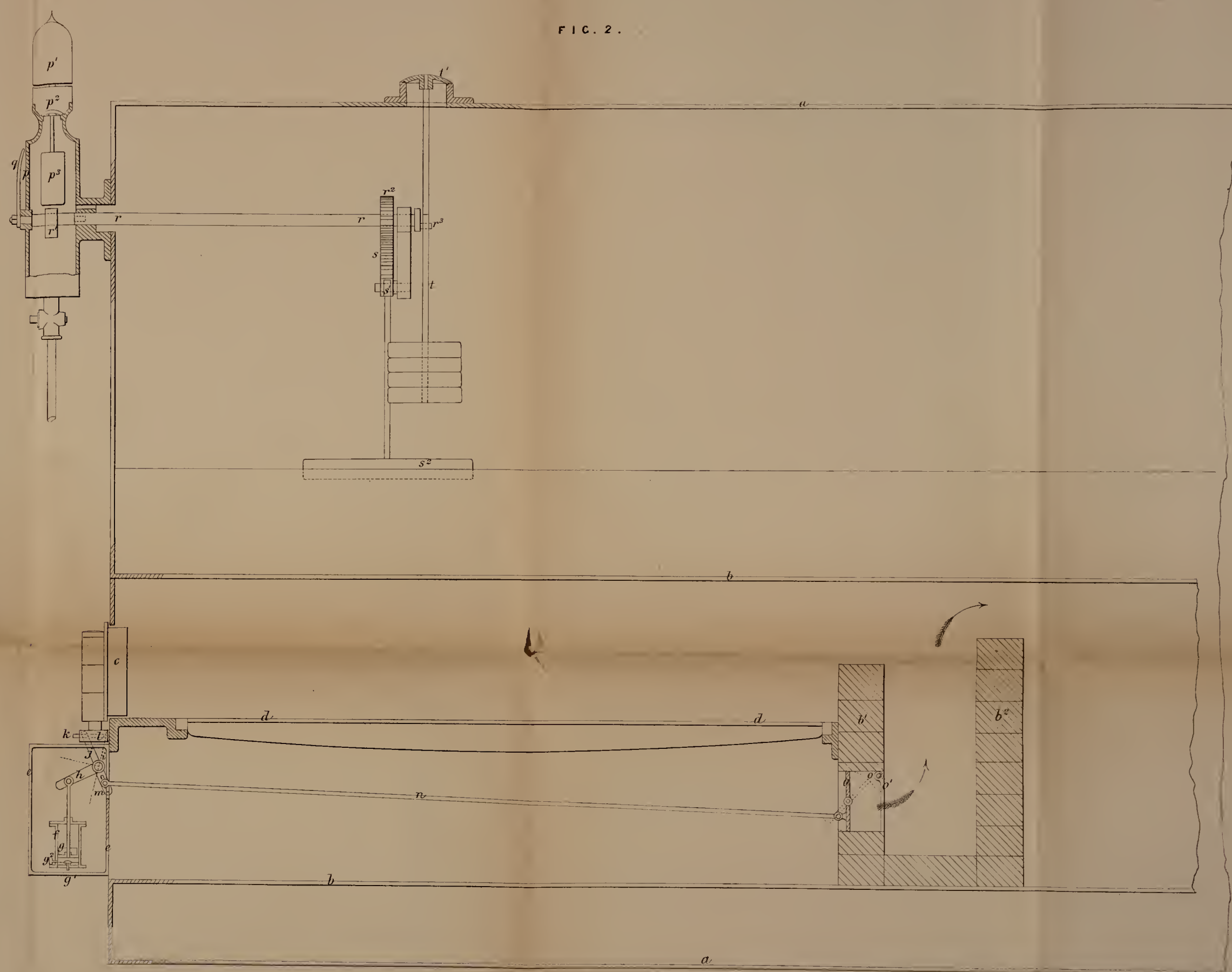
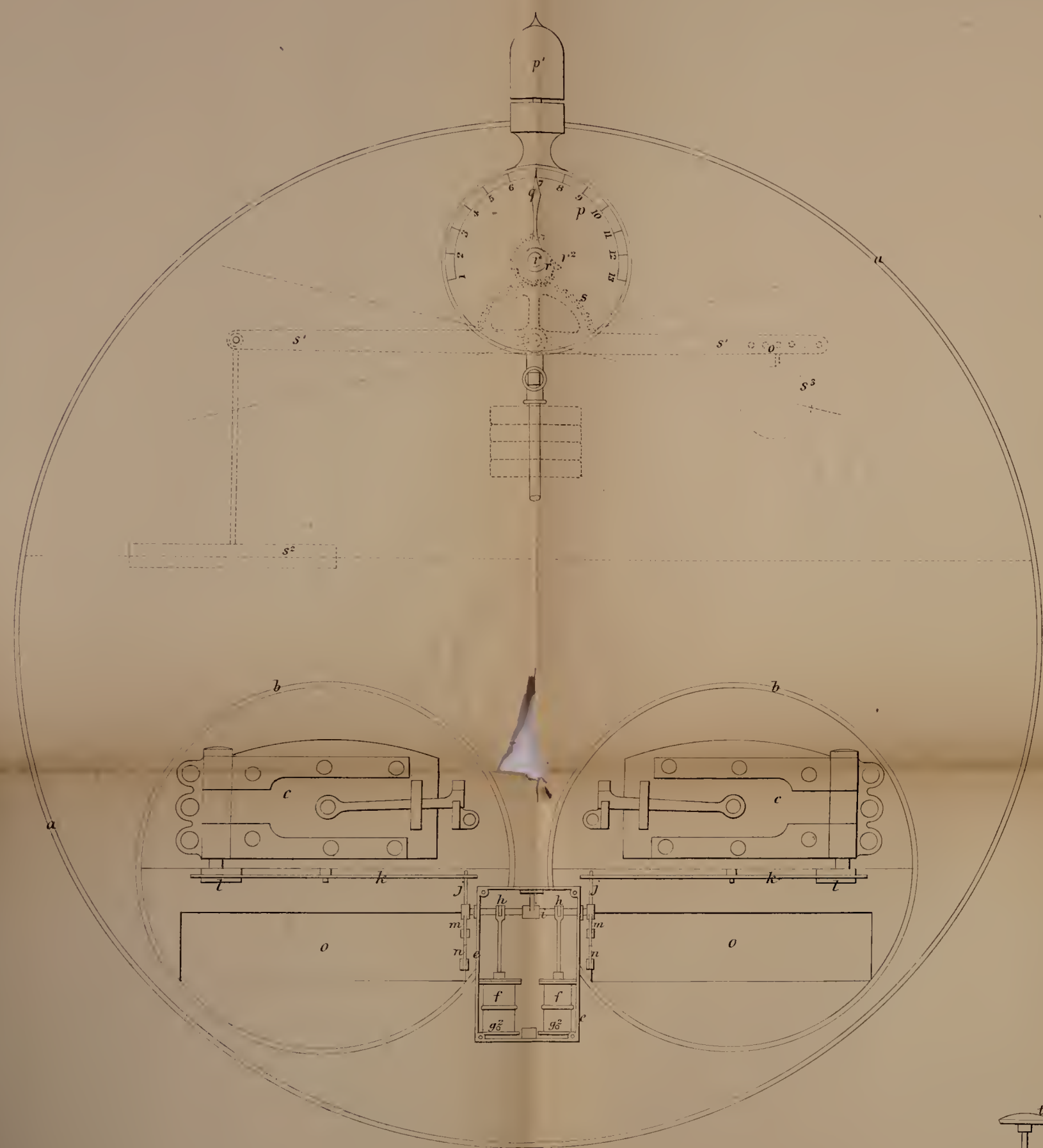
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F I C . 2 .



F I C . 3 .



Scale  $1\frac{1}{2}$  in. = 1 Foot.

